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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/687,308

10/16/2003

James E. Millerd

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12/15/2005

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EXAMINER

DETSCHEL, MARISSA

ART UNIT

PAPER NUMBER

2877

DATE MAILED: 12/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary**Application No.**

10/687,308

Applicant(s)

MILLERD ET AL.

Examiner

Marissa J. Detschel

Art Unit

2877

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 November 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 22-24 is/are allowed.
- 6) ☒ Claim(s) 1-3, 5-7, 9, 12-17 and 19 is/are rejected.
- 7) ☒ Claim(s) 4, 8, 10, 11, 18, 20, and 21 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1-24 have been considered but are moot in view of the new ground(s) of rejection.

The claims as presented invoke 35 U.S.C. 112, 6th paragraph, and were examined as such.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 5-7, 9, 12-17, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Massie (USPN 4,344,707) in view of Feinleib, et al. (USPN 4,399,356).

Regarding claims 1 and 12, Massie discloses a method for correcting wavefront measurements in an imaging system that comprises the steps of:

a) producing an image in a channel of a system using light of a predetermined wavelength

b) measuring a geometric distortion introduced by the system in a light beam

Massie discloses a method for determining wavefront distortions that occur along the transmission path of a light beam in a system (column 1, lines 35-37). These

distortions can be in the form of geometric distortions such as tilt, tip, focus, and astigmatism. (column 1, line 44 to column 2, line 8)

Massie's system further corrects the distortions by:

c) determining a geometric correction matrix corresponding to said geometric distortion introduced by the system in the light beam; and

d) applying said geometric correction matrix to remove geometric distortions from the light beam

Massie's system performs these steps by generating the geometric distortions in the form of "mode signals." These signals are directly usable in a close-looped system for providing on-line corrections to eliminate the distortions in the light beam. (column 2, lines 41-49) These signals are further represented as coefficients in Zernicke polynomial functions. These functions describe the phase of the wavefront in the x-y plane with respect to these geometric distortions or coefficients. (column 3, lines 20-31) The series of coefficients represents a matrix of values.

Massie does not disclose the method of correcting measurement data from the sub-images of a light beam in a multi-channel system, but rather only corrects wavefront distortions in a single light beam introduced by the system.

Feinleib discloses an optical wavefront multi-channel sensing system that produces a sub-image in each channel of the system using a predetermined wavelength. A prism (10) divides an incoming light beam (7) into multiple beams (7a-d) along multiple channels (orthogonal paths). These beams impinge on detector arrays (4a-d) for imaging. (column 4, lines 29-31) It is inherent that distortions can occur in

these multiple beams due to the system (i.e. obscurities in the wavefront splitting device, obscurities in the surrounding environment) as the incoming light beam is sent along a transmission path, split into the separate wavefronts, and sent to the separate detectors. These distortions can interfere with the desired measurements. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the method of correction for wavefronts of Massie in the optical wavefront multi-channel sensing system of Feinleib in order to correct for these distortions in the sub-images, resulting in a more accurate measurement.

Regarding claims 2 and 13, the detectors of Feinleib's device are disclosed as detector arrays with means for dividing each of the sub-images into sub-regions (subapertures) (column 4, lines 41-43). Thus, the distortions in the wavefronts are also detected at the sub-regions. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the method of correction for wavefronts of Massie in the optical wavefront multi-channel sensing system of Feinleib in order to correct for these distortions in the sub-regions, resulting in a more accurate measurement.

In regards to claims 3 and 14, the step for measuring the geometric distortions in Massie's device is taken with regard to a predetermined reference position of an image feature (point- spread function) in the light beam wavefront. The wavefronts are compared with a point-spread function curve indicating the intensity of the beam that includes a peak value. Shifts from this peak intensity indicate a tip or tilt. A widening of

the peak indicates focus. An uneven spread of this point-spread function indicates astigmatism. (column 7, lines 36-47)

Furthermore, regarding claims 3 and 14, the step for determining in Massie's device is carried out by calculating correction factors as required to negate the spatial displacement in each wavefront section. (column 2, lines 41-49)

In regards to claims 5, 6, 15, and 16 the Zernicke polynomial used in Massie's device is an equation describing the wavefront of a light source geometrically in the x-y plane, and therefore is an equation for a surface in the x-y plane. (column 3, lines 15-25)

Regarding claims 7 and 17, step b) of Massie's device is carried out by comparison of the wavefronts with a calibration test pattern known as a point-spread function. (column 7, lines 36-47)

In regards to claims 9 and 19, Massie's discloses that wavefront analysis (i.e. detecting and correcting of distortions in a light source) can be used for light of varying wavelength (i.e. a star or star-like object or a laser beam). (column 1, lines 11-16)
Therefore, it would be inherent to use a light source with means for changing the wavelength to determine wavefront distortions in a multi-channel imaging device.

Allowable Subject Matter

Claims 22-24 are allowed over the prior art.

Claims 4, 8, 10, 11, 18, 20, and 21 are objected to as being dependent on a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

As to claims 22-24, the prior art of record, taken alone or in combination, fails to disclose or render obvious the method of producing a plurality of additional phase maps with varying phase offsets and averaging the phase maps to produce a corrected phase map to calibrate a multi-channel imaging system.

As to claim 4, the prior art of record, taken alone or in combination, fails to disclose or render obvious the use of a cross-correlation algorithm for sub-images of a multi-channel imaging system to measure a spatial displacement among the sub-images introduced by the system.

As to claims 8 and 18, the prior art of record, taken alone or in combination, fails to disclose or render obvious the method of measuring a geometric distortion introduced by the system in a multi-channel imaging system utilizing one of the sub-images of one of the channels as a reference.

As to claims 10, 11, 20, and 21 the prior art of record, taken alone or in combination fails to disclose or render obvious the method of correcting an intensity distortion introduced by the system in a multi-channel imaging system using a transfer-function correction matrix.

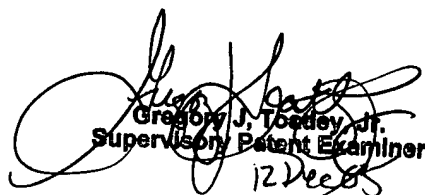
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Marissa J. Detschel whose telephone number is 571-272-2716. The examiner can normally be reached on M-F 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr. can be reached on 571-272-2059. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Marissa Detschel
December 12, 2005
MJD


Gregory J. Toatley, Jr.
Supervisory Patent Examiner
12 Dec 05